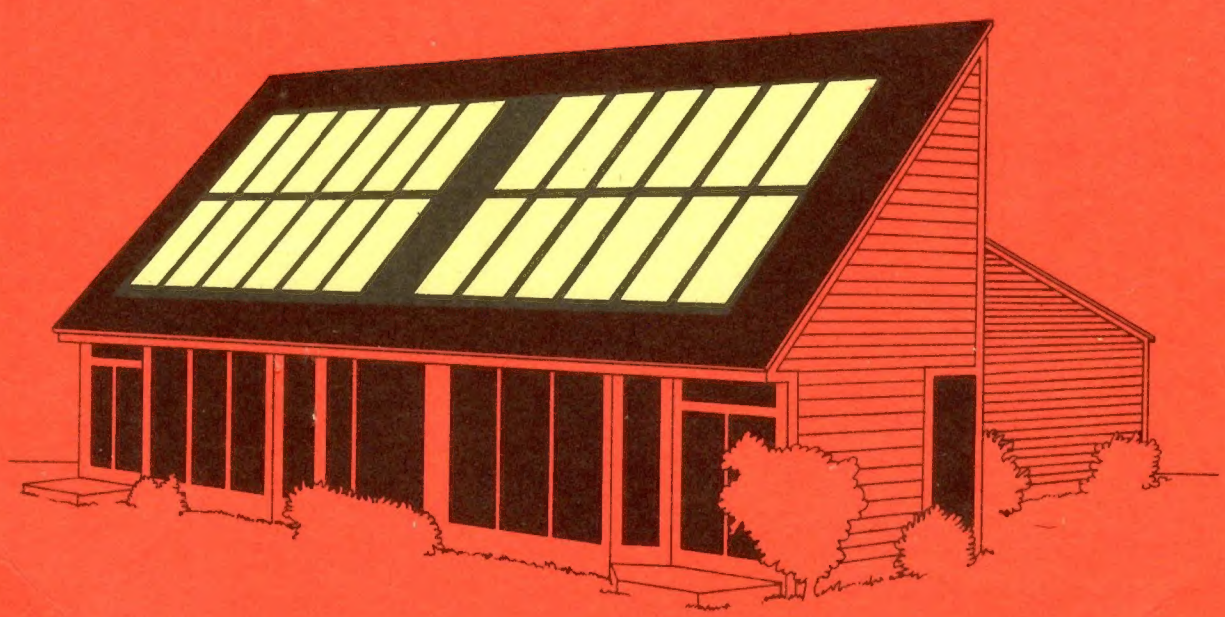
solar ONE

the first house to convert sunlight into electricity and heat

UNIVERSITY OF DELAWARE
INSTITUTE OF
ENERGY CONVERSION

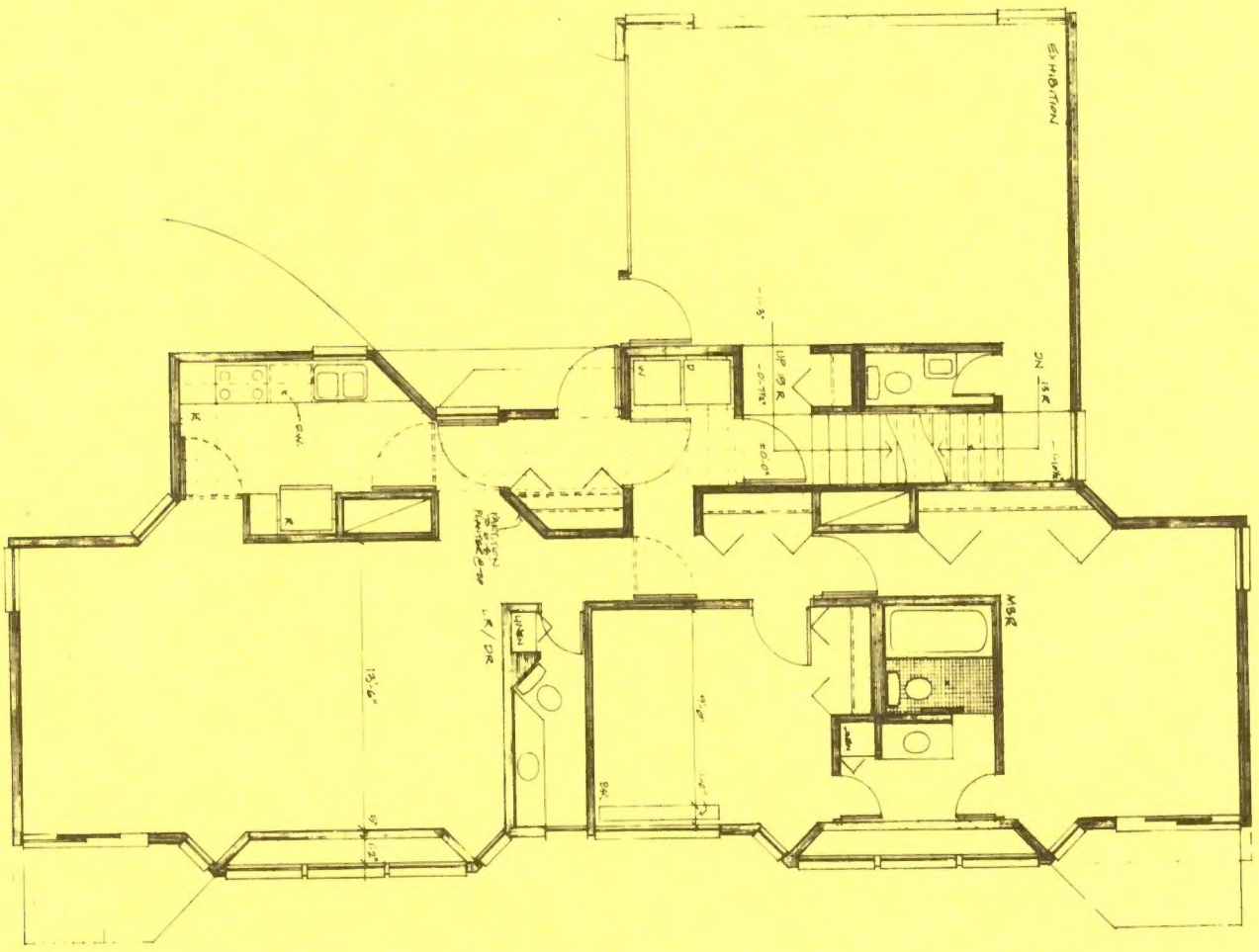


WHY SOLAR ONE?

SOLAR ONE is the first house to directly convert sunlight into *both* heat and electricity for domestic use. Built at the University of Delaware with support from the Delmarva Power and Light Co., SOLAR ONE has been designed as an experimental structure to accumulate data from its solar harvesting system. These data will provide the basis for further development and optimization of the system and its components. This will lead to the design of certain other prototype buildings that will implement these optimized systems.

WHAT DOES IT LOOK LIKE?

SOLAR ONE is unique in its architecture. The artist's conception on the cover shows it to have a high, interesting, 45° roofline, designed for exposure to maximum sunlight.



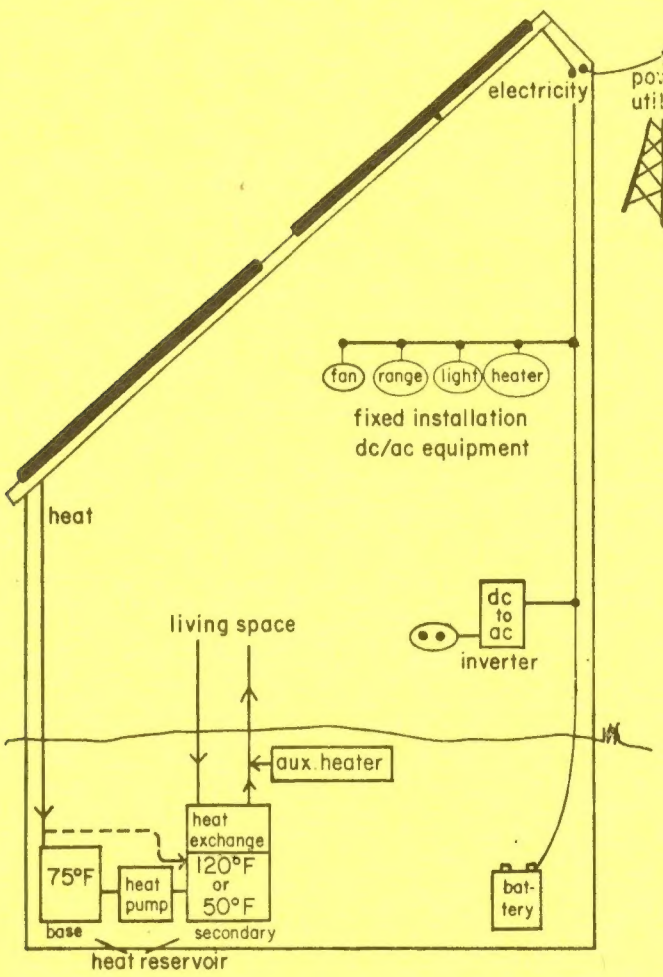
The house has a living room/dining room, two bedrooms and a kitchen as well as a garage and full basement. The upper level currently is devoted to experimental equipment but will be converted into two additional bedrooms in the future.

The roof contains a skylight which is designed to protect the solar collectors during the experimental

period. Below the skylight the solar cell panels and heat collectors are located. The front of the house also contains six solar heat collectors for additional heating during cold winter days. All collectors have plexiglass front coverings.

HOW DOES IT WORK?

SOLAR ONE is a systemized house which converts sunlight directly into heat and electric power. When light strikes the solar panels on the roof, DC electricity is generated by the Cadmium Sulfide (CdS) Solar Cells. In addition, the sunlight heats these solar cells. Air if forced through the solar collectors and is heated by contacting the back of the hot solar cells. Additional black surface panels are provided to boost the heat further.

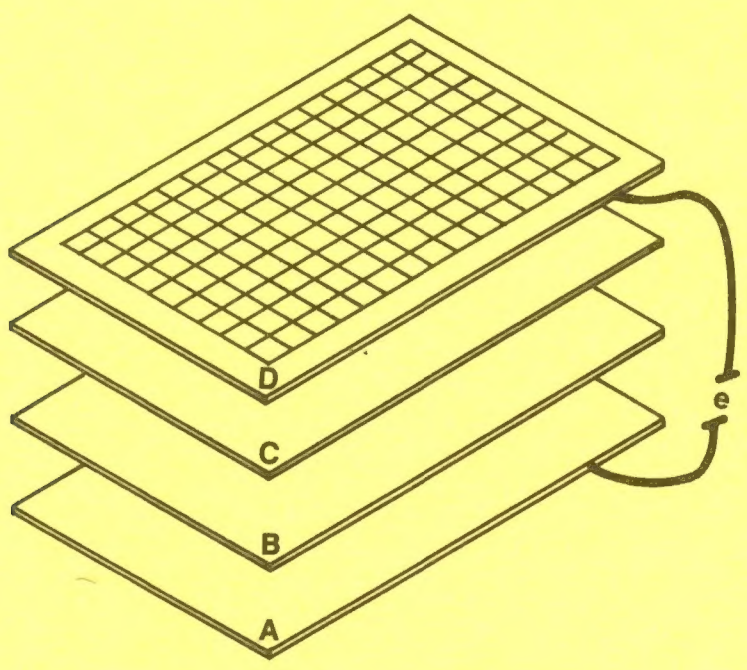


Ductwork conducts the hot air through a storage system containing eutectic salts. As the air passes over the eutectic salt, heat is transferred to the salt and causes it to melt at 120°F. absorbing a large amount of heat known as "Heat of Fusion." In this way heat can be stored in a much smaller volume (6 ft x 6 ft x 6 ft) than in heated rocks or water. During the evening and night hours when the house cools down, its air is circulated through the eutectic

salt containers and now "extracts" this heat of fusion from the salt. The process starts over again when the sun begins to shine. When there is not enough sunshine to heat the house to comfortable temperatures, a heat pump is used to amplify the heat. In this way solar energy can be utilized for house heating even during cloudy winter days.

During the summer, the heat pump is used as an air conditioner and will operate predominately during night hours to freeze another eutectic salt. During day hours house air is circulated through these eutectic salt containers, extracting "coolness" from the salt and cooling the rooms. Night hours are used to freeze the salt since it is easier to cool during night time and more electricity is also available from power utilities.

The use of Cadmium Sulfide Solar Cells and the generation of electricity as well as heat is what distinguishes SOLAR ONE from other solar structures that have been built in the past. The Cadmium Sulfide (CdS) cell is relatively simple in its design. As shown in the illustration, a CdS cell is composed of four basic parts:



A metal foil substrate (A) forms the base electrode upon which (B) cadmium sulfide is vacuum evaporated as a thin film. Then a layer of copper sulfide (Cu_2S) (C) is electroplated onto the CdS (both films together are thinner than a human hair). A metal grid electrode (D) is then placed on top of the first three. Light passes through the

metal grid and activates a current flow in the film sandwich, which can be picked up through the two electrodes. Plastic material is laminated on the entire cell to encapsulate it for protection.

Wiring conducts the electricity (e) from the CdS cells to household units such as an electric range, heaters, lights, etc. Any excess electricity that cannot be immediately used is stored in a series of batteries. The stored energy will be used especially during the hours when electricity is high in demand (afternoon hours) and will help to alleviate power shortages for power utilities.

WHY IS IT IMPORTANT?

SOLAR ONE is an experimental house that will provide information for residential dwellings in the future; it will define how solar energy can supplement conventional energy sources and thereby help alleviate energy shortages.

SOLAR ONE is designed to obtain up to 80% of its heat and electricity from sunlight and the rest from the power utility predominantly at a time when power is available (night hours).

SOLAR ONE is designed to operate in conjunction with the power utility to prove how solar energy can contribute to "Peak Shaving" and can supply "Power on Demand" to eliminate "brownouts" and "blackouts".

SOLAR ONE has been built with contributions from the University of Delaware and the Delmarva Power and Light Company. It was designed by Harry Weese Associates with assistance by Cosentini Associates and the Institute of Energy Conversion. Further contributions from Frederick G. Krapf and Son Inc., York Air Conditioning Division of Borg-Warner, Rohm and Haas Corporation, ESB, and Alcoa Aluminum are gratefully acknowledged.

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Wilmington, Delaware 19899

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Published By The
Institute of Energy Conversion
University of Delaware
Newark, Delaware 19711

24420000043G